MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY

Permitting and Compliance Division
Water Protection Bureau
P.O. Box 200901
Helena, MT 59620-0901

Permit Fact Sheet
Montana Ground Water Pollution Control System (MGWPCS)

Permittee:	Ueland Land Development LLC.
Permit No.:	MTX000204
Receiving Water:	Class I Ground Water
Facility Information	
Name:	Homestake Meadows Phase II wastewater treatment plant
Location	N 45º 55' 06" latitude and W 112º 26' 59" longitude.
Mailing Address:	122181 West Browns Gulch Road Butte, Montana 59701
Contact:	Ron Ueland
Phone:	406-782-4670
Fee Information	
Number of Outfalls:	1
Outfall - Type:	001A – Subsurface drainfield 001B – Subsurface drainfield 001C – Subsurface drainfield 001D – Subsurface drainfield

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I. Permit Status

This is a new permit for the proposed Homestake Meadows Subdivision Phase 2 wastewater treatment system Butte, MT. The proposed subdivision is located east of Butte, MT and north of Blacktail Canyon Road The Applicant, Ron Ueland, submitted a permit application (GW-1) on October 4, 2007 in accordance with ARM 17.30.1023 (3) and (4). All fees were received on October 18, 2007. A deficiency letter was sent December 4, 2007. A response to the deficiency letter was received May 08, 2008 which included the missing DEA Form-1 and updated GW-1. The application was deemed complete on June 5, 2008. The Department also received an application for a major subdivision, which has been assigned EQ# 08-1369.

II.Facility Information

A. Facility Description

The proposed Homestake Meadows Major Subdivision (HMMS) wastewater treatment system will treat the domestic wastewater produced from 58 lots of the major subdivision and two neighboring lots. Influent will be transported from the individual homes via a grinder pump station to a low pressure sewer main. Influent is delivered from the low pressure sewer mains to an International Wastewater System (IWS) wastewater treatment system. The IWS system is a Sequencing Batch Reactor (SBR) package plant. The influent from the collection system enters distribution/surge tanks prior to being distributed to three SBR tanks for secondary treatment. The SBR tanks provide secondary treatment removing biological oxygen demand (BOD) and nitrogen within each tank by alternating between aerobic and anoxic conditions with in the tank. After the wastewater has had time to settle solids the clear decant is pumped to a filter feed tank. Effluent is pumped from the filter feed tank to a sand filter. Prior to effluent reaching the sand filter a coagulant is added in the discharge line for polishing. After the sand filter the effluent passes through UV disinfection then trough a turbidimeter. If the turbidity of the effluent is greater than 5 Nephelometric Turbidity Units (NTU) the effluent is returned to the head of the plant for additional treatment. If the effluent is at or below a turbidity of 5 NTU it is sent to a dose tank. From the dose tank the effluent is gravity feed to a pump vault where 4 pumps, each assigned a different drainfield, distribute effluent for finial disposal. The wastewater treatment system will have the capacity to discharge a daily maximum of 23,800 gpd (design capacity) to the groundwater.

The proposed permit authorizes discharge of residential wastewater to one (1) of (4) pressure dosed drainfields, which will discharge to ground water. The drainfields are located adjacent to the treatment plant all within the boundaries of the subdivision. The drainfields will be designated starting with the northern most field designated as 001A then moving south from there to 001B, 001C and 001D. The outfalls will be located approximately 1.0- 2.0 feet below the ground surface and all are adjacent to each other at N 45º 55’ 06” latitude and W 112º 26’ 59” longitude.

B. Effluent Characteristics

The wastewater treatment system is new, therefore, no effluent samples have been collected or analyzed. HKM Engineering submitted effluent quality data from the certification report provided by the National Science Foundation (NSF). The certification was performed at the Moon Lake Ranch Subdivision, located a few miles west of Boise, Idaho. The Moon Lake Ranch Subdivision has 18 homes and had and average flow 2,311 gpd. The system tested only had one SBR tank while the system proposed for HMMS will have three slightly larger tanks. The IWS system has also been certified as meeting level II classification by the Department. The effluent quality data for IWS facilities is listed in Table 1.

Table 1. Effluent Quality

Parameter	Maximum	Average	Units
Nitrate +Nitrite	8.8	3.1	mg/L
Phosphorous	2.7	1.3	mg/L
Biological Oxygen Demand	8	4	mg/L
Ammonia	2.5	0.3	mg/L
Total Kjeldahl Nitrogen	3.5	1.2	mg/L
Escherichia Coli	120	2	MPN

III. Proposed Technology Based Effluent Limits

A level II system must provide at least a 60 % removal of total nitrogen in raw wastewater or produce effluent with a total nitrogen concentration of 24 mg/L or less [ARM 17.30.702 (11)].

The applicant submitted NSF "Environmental Technology Verification Report" (HKM 2008) that reported an influent annual average Total Nitrogen (TN) concentration of 37.7 mg/L with an average effluent TN of 4.4 mg/L and average effluent ammonia concentration of 0.3 of mg/L. TN is the sum of Nitrate, Nitrite and Ammonia. The percent of TN removal is calculated from the difference between raw sewage influent TN concentration and the effluent TN prior to discharge divided by the influent TN concentration multiplied by 100.

$$88.33\ \%\ removal = \frac{37.7\ mg/L - 4.4\ mg/L}{37.7\ mg/L} \times 100$$

Based on data submitted to the Department by the applicant this effluent is expected to receive at least 60% reduction of Total Nitrogen. This is more stringent than the 24 mg/L required in ARM 17.30.702 (11). Therefore a value of 4.4 mg/L will be used as a permit effluent limit. The technology-based permit limit for total nitrogen will be set at 4.5 mg/L (see Table 1).

The proposed technology based effluent limits for outfall 001 are presented in Table 1.

Table 1. Technology Based Effluent Limit for Outfall 001

Parameter	**Concentration (mg/L) Daily Maximum (1)**
Total Nitrogen as N	4.4

(1) See definitions, Part I.A of the permit

IV. Water-Quality Based Effluent Limits

A. Receiving Water

Outfall 001A, 001B, 001C and 001D discharges to ground water. According to the well logs in the area, the first water bearing zone of the aquifer is comprised of granite or decomposing granite. Static water levels of wells used to triangulate ground water flow direction as reported by HKM indicate static water levels at ranging from 3.13 to 42.03, as measured from the top of the casing. HKM drilled seven monitoring wells designated MW-1 through MW-7. These wells were drilled in conjunction with Phase 1 of this project. Monitoring wells MW-2, MW-3 and MW-4 were drilled to a depth of 10 to 20 feet beyond first ground water and MW-1, which was placed in a low lying area near the bottom of the drainage and has static water level of 3.13 feet, was drilled to 63 feet. These wells were completed at a shallow depth in the aquifer so that the shallowest ground water could be evaluated. The local geology does not support a distinct upper and lower aquifer (HKM 2008). There is a fracture bedrock overlay by a decomposing layer from the parent material.

The HKM aquifer tests assumed an aquifer thickness from static water level to the bottom of the well. The testing estimated the hydraulic conductivity of 8.71 ft/day. This estimate was derived from pump tests conducted on wells MW-3, MW-5, MW-6 and MW-7. MW-3 and MW-5 were tested by conducting a short duration test of 1 to 2 hours. MW-6 and MW-7 were tested at a constant rate for 24 hours. The hydraulic gradient was determined by taking measurements of the potentiometric water surface in all the existing wells. Ground water contours underneath the proposed outfall produce a hydraulic gradient of .050 ft/ft

The permitte submitted groundwater data from many wells in the area with all but one down gradient, and many of the wells are local single family wells completed well below first water. The results from the up gradient well (most northern MW-2) are listed in table 2.

Table 2. Ground Water Monitoring Results

Well Identification	Date Samples	Nitrate + Nitrite	Chloride	Total Dissolved Solids	Conductivity (umhos/cm)
MW-2	8/10/2007	.659	15.6	182	15.6
MW-2	7/18/06	.732	15.5	NA*	NA*
MW-2	6/19/06	.752	15.5	NA*	NA*
MW-2	5/30/06	.78	16.2	NA*	NA*
MW-2	4/16/06	.716	15	NA*	NA*

* data not supplied

Samples from MW-1, MW-3 and MW-8 yielded specific conductivity values of 261, 460 and 265 microSiemens/cm respectively. Therefore, the receiving water for Outfall 001 is Class I ground water (ground water with specific conductance equal to or less than 1,000 microSiemens/cm) as defined by the Administrative Rules of Montana [ARM 17.30.1006 (1)(a)]. Class I ground water is to be maintained for the following beneficial uses with little or no treatment: public and private water supplies, culinary and food processing purposes, irrigation, drinking water for livestock and wildlife and for industrial and commercial uses. Water quality human health standards (DEQ-7, February 2006) apply to concentrations of substances in Class I ground waters. Pursuant to ARM 17.30.1006(1)(b)(ii) for parameters that are not listed in DEQ-7, there shall be no increase in Class I receiving water concentrations to levels that render the water harmful, detrimental or injurious to the beneficial uses listed for Class I waters. The Department may use any credible information to determine these levels. Class I ground waters are considered high quality waters and are subject to Montana's Nondegradation Policy [75-5-303, Montana Code Annotated (MCA)].

The closest surface with respect to the drainfields and ground water movement is Blacktail creek approximately 800 ft down gradient of the proposed discharge. This distance value will be used to determine nonsignificancant changes in water quality with a phosphorous breakthrough calculation.

B. Basis for Water Quality Based Effluent Limits

Water quality limitations must be established in permits to control all pollutant or pollutant parameters that are or may be discharged at a level which will cause an excursion from any state water quality standard. The receiving water for Outfall 001A and 001B is Class I ground water as defined by the Administrative Rules of Montana [ARM 17.30.1006 (1)(a)]. Class I ground water is suitable for the following beneficial uses with little or no treatment: public and private water supplies, culinary and food processing purposes, irrigation, drinking water for livestock and wildlife and for industrial and commercial uses. Secondary and human health standards (WQB-7, January 2004) apply to concentrations of substances in Class I ground waters (water with specific conductance equal to or less than 1,000 microSiemens/cm). The Department is required to clearly specify in any permit the limitations imposed as to the volume, strength, and other significant characteristics of discharges to state waters [75-5-402(3), MCA].

C. Nitrate

Class I ground water is considered high quality water and is subject to Montana's Nondegradation Policy 17.30.705. The proposed wastewater system is considered a new or increased source as pursuant to ARM 17.30.702 (18)(a). The applicable ground water standard, a nitrate concentration of 7.5 mg/L at the end of the proposed standard mixing zone is based on nondegradation rules [ARM 17.30.715 (1)(d)(iii)].

Total nitrogen is the sum of nitrate + nitrite as N (NO_3+NO_2-N) + TKN. These effluent limits ensure the nitrate plus nitrite (as N) concentration at the end of the ground water mixing zone are at or below the nondegradation significance criterion of 7.5 mg/L.

D. Phosphorus

Phosphorus is removed mainly through soil absorption processes, which vary based on soil composition. The 50-year breakthrough nondegradation criterion is based on the amount of soil available to adsorb the average load of phosphorus from the wastewater source, between the discharge point and the closest downgradient surface water. The total phosphorus limitations are imposed to ensure that the quality of the effluent meets the nondegradation limit prior to discharge into any surface water [ARM 17.30.715(1)(e)]. Phosphorous breakthrough analysis calculations are mass based therefore the limit will be a load based discharge limit.

The permitte reported an advanced treatment limit maximum of less then 3mg/L for phosphorous. Using the distance to the receiving surface water (Blacktail Creek) approximately 800 feet southwest and down gradient of the proposed drainfields and a phosphorous load value of 0.5955 lbs/day or 217 lbs/yr the breakthrough time for phosphorus is 80 years. The phosphorous load is based on the decreased phosphorous concentrations expected from the advanced treatment system. The breakthrough time of 80.0 years is considered nonsignificant pursuant to Montana's Nondegradation criteria [ARM 17.30.715(1)(e)].

A phosphorous breakthrough would occur in 50 years (the level of significant degradation) at an effluent load of 0.951 lbs/day per or 348 lbs/year. To derive a concentration of phosphorous from a load, load (lbs/day) is divided by the product of flow (the design capacity, 23,000 gpd) and 8.34^{-6}.

$$\frac{0.9534\ lbs\ /\ day}{23,800\ gpd\ \times 8.34^{-6}(lb\ /\ g)/(mg\ /\ l)} = 0.4.8032\ mg\ /\ l$$

Therefore the effluent limit for the Total Phosphorous load discharged to the drainfield shall not exceed 4.8032 mg/l or 0.9534 lbs/day or 348 lbs/year for Outfall 001A, 001B, 001C and 001D. The water quality based effluent limit for Outfall 001A, 001B, 001C and 001D will therefore be set at 4.8032 mg/l and 0.9534 lb/day.

E. *Escherichia Coli*

The systematic dosing of the drainfield and the soil matrix of the drainfield provide natural disinfection, which will enable the DEQ-7 human health standard of <1 organism/100 ml to be achieved in the groundwater. Pathogen transport research indicates a 3-log decrease in pathogens for every meter of horizontal movement through the vadose zone and a 6-log decrease in pathogen transport for every 20 m in vertical transport through the saturated zone (Woessner,

1998). The proposed system discharges the effluent about 3 m above the ground water. A 3-log removal in the vadose zone indicates less than 1 colony per 100 ml within 3-feet of the discharge. A mixing zone will not be granted for pathogens.

An *Escherichia Coli (E coli)* limit has not been established in this permit due to the following site-specific criteria:

- UV Disinfection
- The drainfield is pressured-dosed, which minimizes saturated conditions and therefore maximizes the die-off rate in natural sediments.
- The permittee is required to meet the *E Coli* ground water standard of less than 1 organism/100 ml at the end of the mixing zone.

The proposed water quality based, nondegradation based effluent limits for outfalls 001A and 001B are presented in Table 3.

Table 3. Proposed Water-Quality Effluent Limits for Outfalls 001

Parameter	Units	Concentration Daily Maximum (1)	90 Day Average Load (2) (lbs/ per day)
Total Nitrogen as N	mg/L	7.5	18.77
Total Phosphorus as P	mg/L	4.8032	.9534

(1) See definitions, Part I.A of the permit
(2) load calculation: lb/d = concentration (mg/L) x flow (gpd) x 8.34^{-6}

F. Mixing Zone

The permittee has proposed to discharge all wastewater from Outfalls 001A, 001B, 001C and 001D to ground water. Ground water in the immediate vicinity of the discharge is classified as class I water as defined by ARM 17.30.1006 (1)(a) and discussed in section IV. A of this document. The permittee did request a standard 500-foot ground water mixing zone for outfall 001A, 001B 001C and 001D. According to HKM (2008), the site geology consists of site being fractured bedrock overlain by decomposing soil and no barrier exists to impede wastewater to enter the fracture bedrock. ARM 17.30.506(g) “Aquifer characteristics” when currently available data indicate that the movement of ground water or pollutants within the subsurface can not be accurately predicted, such as the movement of ground water through fractures, and also indicate that this unpredictability might result in adverse impacts due to a particular concentration of a parameter in the mixing zone. ARM 17.30.506(b) states that the existence of a drinking water intake, a zone of influence around a drinking water well …within or immediately adjacent to the proposed mixing zone will support a finding that a mixing zone is not appropriate. The applicant did not submit the information needed to make a determination as to the fate and transpost of the effluent therefore a groundwater mixing zone will not be granted.

V. Final Effluent Limits

The proposed final effluent limitations for Outfalls 001A, 001B 001C and 001D summarized in Table 4 and are based on the more restrictive of the technology based effluent limits, the water quality based effluent limits and the water quality standards of DEQ-7. Because the mixing zone was not approved the permittee will be required to meet the ground water quality standard for nitrogen (7.5 mg/L) at the point of last control prior to discharge to ground water.

Class I ground water is to be maintained for the following beneficial uses with little or no treatment: public and private water supplies, culinary and food processing purposes, irrigation, drinking water for livestock and wildlife and for industrial and commercial uses. Water quality human health standards (DEQ-7, February 2006) apply to concentrations of substances in Class I ground waters. Pursuant to 75-5-402 (3), ARM 17.30.1031(2) and ARM 17.30.1006 (1)(a) the Department will implement limits such that the discharge from outfall 001 shall not cause increase of a parameter to a level that renders the water harmful, detrimental or injurious to the beneficial uses listed for class I water.

The permittee submitted technical information indicating a design capacity of 23,800 gpd. The design flow is the peak flow (daily or instantaneous) for sizing hydraulic facilities, such as pumps, piping, storage and adsorption systems and means the average daily flow for sizing other treatment systems. This value is used in calculations for phosphorous load limits and for calculations for determining the allowable nitrogen concentration at the end of the mixing zone. The combined flow limit from outfalls 001A, 001B, 001C and 001D shall not exceed the design capacity of 23,800 gpd based on the daily average.

Table 4. Final Numeric Effluent Limits for Outfall 001A, 001B, 001C and 001D

Parameter	Units	Concentration Daily Maximum (1)	90 Day Average Load(2) (lbs/ per day)
Total Nitrogen as N	mg/L	7.5	1.49
Total Phosphorus as P	mg/L	4.8032	.9534

(1) See definitions, Part I.A of the permit
(2) load calculation: lb/d = concentration (mg/L) x flow (gpd) x 8.34^{-6}
NA = Not Applicable

VI. Monitoring Requirements

Effluent limits are established to protect the ground water from a change in water quality that would cause degradation [ARM 17.30.715] or limit a beneficial use [ARM 17.30.1006(1)(a)]. Effluent monitoring is necessary to ensure the compliance with permit limits, non-exceedence of state water quality standards and effective treatment of the wastewater discharged from the facility. Samples or measurements shall be representative of the volume and nature of the monitored discharge. Water quality monitoring of the effluent shall occur after Ultra violet disinfection and prior to discharge into the drainfield's.

The permittee shall monitor the flow of the effluent continuously and report the gallons per day based on the daily maximum. The measurement method shall be either by flow meter and

recorder or a totalizing flow meter; dose counts or pump run-times will not be accepted. Flow measurement equipment must have the ability to report a daily maximum flow. To ensure that the Total phosphorous load is calculated correctly, an accurate daily flow must be measured. Daily flow shall be measured when required sampling is conducted (flow measurement must correspond to sample collection to calculate an accurate load). The effluent flow rate is to be a measured and reported as a daily maximum flow and a 30 day average.

The permittee shall monitor the effluent for the constituents in Table 5 at the frequency and with the type of measurement indicated. If no discharge occurs during the entire monitoring period, it shall be stated in a Discharge Monitoring Report that no discharge occurred.

Table 5. Outfall 001 Parameters Monitored in the Effluent Prior to Discharge

Parameter	Frequency	Sample Type[(1)]
Effluent Flow Rate, gpd[(2) (3)]	Daily	Continuous
Biological Oxygen Demand (BOD_5), mg/L	Quarterly	Composite
Total Kjeldahl Nitrogen (TKN), mg/L	Quarterly	Composite
NO_3+NO_2 as N, mg/L	Quarterly	Composite
Total Phosphorus (as P), mg/L	Quarterly	Composite
Total Suspended Solids (TSS) mg/L	Quarterly	Composite
Total Nitrogen (as N), mg/L	Quarterly	Calculated
Total Nitrogen (as N), lb/d	Quarterly	Calculated
Total Phosphorus (as P), lb/d	Quarterly	Calculated
Chloride, mg/L	Quarterly	Composite

(1) See definitions, Part I.A of the permit
(2) If no discharge occurs during the reporting period, "no discharge" shall be recorded on the DMR report form
(3) Permittee is to report the daily maximum and 7 day average

A. Ground Water Monitoring

Pursuant to 17.30.1031, all issued MGWPCS permits must contain special conditions which will assure compliance with the ground water quality standards. These special conditions include, but are not limited to, the self monitoring requirements for each discharge, monitoring well configuration, pollutants to be monitored, frequency of monitoring, recording and reporting and analytical methods to be utilized by the permittee.

Ground water monitoring will be required in this permit due to the following site-specific criteria:

- This area is experiencing rapid growth and development.
- The presence of a Class 1 receiving water and the need to protect existing and future beneficial uses.
- Proximity of existing wells down gradient of the proposed discharge

- The aquifer is fractured bedrock.
- The need to determine the effects of the proposed discharge to the receiving water

To ensure that these requirements are met, the permittee will be required to monitor ground water for those parameters and at the frequency listed in table 6.

Table 6. Monitoring Parameters for Monitoring Well:

Parameter	Frequency	Sample Type (1)
Static Water Level (SWL) (feet below the casing top)	Biannual	Instantaneous
Specific Conductance, µmhos/cm	Biannual	Grab
Chloride, mg/L	Biannual	Grab
Escherichia Coli (Organisms/100 m*l*)	Biannual	Grab
Total Kjeldahl Nitrogen (TKN), mg/L	Biannual	Grab
NO_3 mg/L	Biannual	Grab
NO_2 mg/L	Biannual	Grab

(1) See definitions, Part I.A of this permit

VII. Significance Determination

The Department has determined that the discharge constitutes a new or increased source and is subject to Montana Nondegradation Policy (75-5-303, MCA; M 17.30.702(16)). Nitrogen concentrations are predicted to be less than 7.5 mg/L (DEQ nitrate sensitivity analysis 2007). Phosphorus load limits are based on nondegradation significance criteria for 50-year break-through to surface water in accordance with ARM 17.30.715(1)(e) (DEQ phosphorous break through analysis 2007). The Department has determined this discharge to be nonsignificant with respect to nitrogen and phosphorous concentrations discharged to state waters.

VIII.Special Conditions

a) Effluent Flow Measurement

To ensure that required monitoring loads are calculated correctly, an accurate daily discharge must be measured. The permittee shall monitor the flow of the effluent continuously. Effluent flow monitoring shall begin upon the effective date of the permit. Effluent flow shall be monitored following UV disinfection and immediately prior to discharge into the drainfield's as described in section VI.

b) Monitoring Well Installation

Within 90 days of the effective date of the permit the permittee shall submit to the Department for approval a plan for ground water monitoring well installation as well as a brief summary of a monitoring, sampling and analysis plan for monitoring wells installed onsite. The plan shall

include the location, conceptual design and construction methods of the planned ground water monitoring wells, and the monitoring, sampling and analysis methods that will be used to meet the monitoring required in the Permit. The well shall be located on the 100 feet from the edge of the drainfields (outfall 001a and 001b) along the centerline in the direction of flow as Stated by HKM (2008). The well shall be drilled in to 15 feet below first water.

Prior to discharge the permittee shall submit to the Department a brief report or letter documenting the results of the monitoring well installation including the final location of the installed monitoring well, construction details for the well and a report on ground water quality in the well. Ground water quality analysis shall include those parameters listed in Table 6. Ground water quality monitoring shall begin upon installation of the well and continue though the duration of the permit.

IX. Information Source

In the development of the effluent limitations, monitoring requirements and special conditions for the draft permit, the following information sources were used to establish the basis of the draft permit and are hereby referenced:

ARM Title 17, Chapter 30, Sub-chapter 5 - Mixing Zones in Surface and Ground Water, September 1999.

ARM Title 17, Chapter 30, Sub-chapter 7 - Nondegradation of Water Quality, March 2000.

ARM Title 17, Chapter 30, Sub-chapter 10 - Montana Ground Water Pollution Control System (MGWPCS), March 2002

Department of Environmental Quality, Nitrate Sensitivity Analysis, 2007

Department of Environmental Quality Phosphorous Breakthrough Analysis 2007

MSE-HKM Engineering. MGWPCS permit application submitted to DEQ August 28, 2007

MSE-HKM Engineering. MGWPCS Supplemental Permit Application Materials. Received by the Department May 08, 2008

Prepared By: John McDunn August 22, 2008